

STEM SUMMIT – 2007
Elementary School Mathematics
is NOT Elementary

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Goal

Provide elementary school teachers with a deep understanding of the math they teach.

- If our third grade teachers read at the sixth grade level, there would be cries for action.
- However, many elementary teachers can't "do" sixth grade math.

How do you teach a mathematical subject when you aren't proficient in it?

You focus on rules, procedures and memorization; or on manipulatives, games and activities that you can't readily connect to concepts.

Epiphany

Elementary Math
is not elementary

Easy??

- Reading a first grade book is easy
- So teaching reading to first graders is easy

- First grade math is easy
- So teaching first grade math is easy

Mathematical Habits

Math must be taught, *at all levels*,
with a focus on understanding.

Memorization of number facts is essential;
but it's easier with understanding.

$$8 \times 6 = ?$$

It's double 4×6

The habit of memorizing rules and algorithms without understanding is counterproductive. Its negative effects become particularly apparent as students move into middle school.

Teachers who don't understand math well can't teach for understanding.

CBMS Recommendations

- **Recommendation 1.** *Prospective teachers need mathematics courses that develop a deep understanding of the mathematics they will teach.*
- **Recommendation 2.** *Although the quality of mathematical preparation is more important than the quantity, the following amount of mathematics coursework for prospective teachers is recommended.*

Prospective elementary grade teachers should be required to take at least 9 semester-hours on fundamental ideas of elementary school mathematics.

What Courses? (Past)

Currently most WSC elementary education majors take:

1. Math Concepts I - Number and Operations and Patterns, Functions and Algebra
2. Math Concepts II - Geometry, Measurement, Probability and Statistics

What Courses? (Future)

Here's what we're headed:

1. Number and Operations (aka arithmetic)
2. Geometry, Measurement, Probability and Statistics
3. Patterns, Functions and Algebra (aka algebra for teachers)

Number and Operations

Course Organization

- Place Value
- Definitions of the four operations and models for explaining them
- Problem Solving
- Development of algorithms, Why they work
- Basic number theory – primes, divisibility, gcf, lcm
- Fractions
- Ratios, Percents, Rates
- Negative Numbers
- Decimal Fractions

Arithmetic is fundamental to mathematics and science in the same way that reading is fundamental to all of education.

Course Goals

- Present arithmetic as a coherent topic based upon definitions and fundamental property (axioms).
- Shift in perspective from *how* to *why*.
- Arithmetic is not just a bunch of rules to memorize.

Example - Division

$6 \div 0 = ?$ and why?

Few students or teachers know the correct answer. Fewer know why

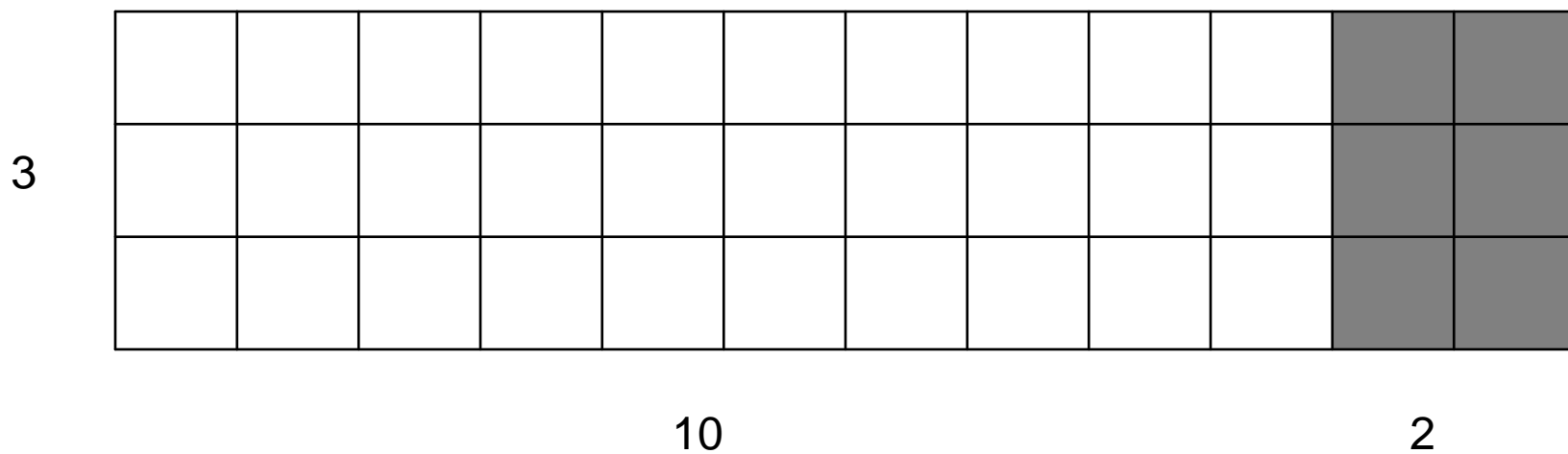
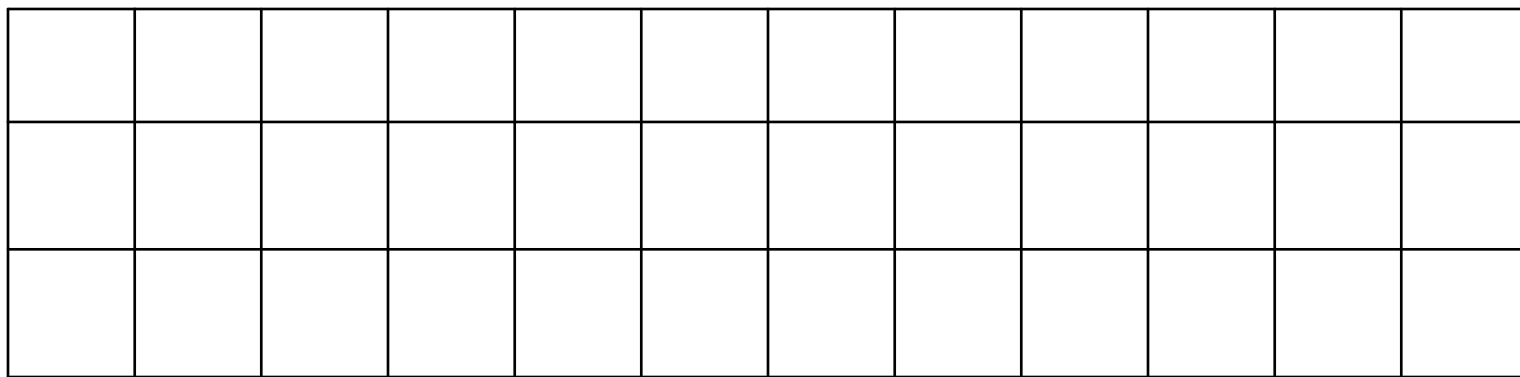
Example - Fractions

Many college students don't know how to add and multiply fractions. It's important for teachers to understand that operations on fractions are just extensions of the same operations on whole numbers.

Example - Multiplication

3×5

$$3 \times 12 = (3 \times 10) + (3 \times 2)$$



$$24 \times 32$$

	30	2
20	600	40
4	120	8

$$(a + b)(a + b) = a^2 + 2ab + b^2$$

